REMARKS

Further examination and reconsideration of the instant patent application in view of the above amendments is respectfully requested. Claims 1-9 and 11-27 remain pending. Claims 1-9 and 11-27 are rejected. Claims 1, 9 and 19 are amended herein. No new matter has been added.

35 U.S.C. §102(e)

Claims 9-14 and 19-23 stand rejected under 35 U.S.C. §102(e) as being anticipated by United States Patent 6,052,035 by Nolan et al., hereinafter referred to as the "Nolan" reference. Applicant has reviewed the cited reference and respectfully submits that the embodiments of the present invention as recited in Claims 9-14 and 19-23 are not anticipated by Nolan in view of the following rationale.

Applicant respectfully directs the Examiner to independent Claim 9 that recites that an embodiment of the present invention is directed to (emphasis added):

> A microcontroller comprising:
> a bus;
> a processor coupled to said bus;
> a memory unit coupled to said bus;
> a plurality of input/output pins; and
> a timer circuit coupled to said bus for performing a timing function, said timer circuit comprising a relaxation oscillator circuit having a first power mode associated with a first current source and a second power mode associated with a second current source, said first power mode and said second power mode being switchable under a control, wherein said relaxation oscillator circuit comprises:
> said first current source coupled to said control for establishing a first reference voltage for use in causing said

relaxation oscillator to operate in a first power mode to generate a clock of a first accuracy, wherein said first current source is not used during said second power mode; and

said second current source coupled to said control for establishing a second reference voltage for use in causing said relaxation oscillator to operate in a second power mode to generate a clock of a second accuracy.

Independent Claim 19 recites similar limitations. Claims 10-14 that depend from independent Claim 9 and Claims 20-23 that depend from independent Claim 19 provide further recitations of the features of the present invention.

Nolan and the claimed invention are very different. Applicant understands Nolan to teach an oscillator with temperature compensation that includes two current generators. In order to compensate for temperature variations, Nolan teaches that the outputs of the two current generators are combined to generate a capacitor charging current. In particular, Nolan teaches that the two current generators work in combination to generate a summed current, regardless of the operating mode of the oscillator.

With reference to Figure 3 of Nolan, a precision relaxation oscillator 1 includes first current generator 200, which is a Complementary to Absolute Temperature (CTAT) current generator, and second current generator 300, which is a Proportional to Absolute Temperature (PTAT) current generator (col. 3, lines 13-19). The CTAT 200 and the PTAT 300 current generators compensate for the effects of temperature variation on internal components by providing offsetting currents (col. 3, lines 24-30).

The offsetting currents, CTAT current 290 and PTAT current 390, are combined to form the capacitor charging current I_{CCC} 190 (col. 3, lines 30-33).

"Because the CTAT 290 and PTAT 390 currents are approximately linear and of opposite slope with respect to temperature, the result of the summation is an I_{CCC} 190 that is nearly independent of temperature" (col. 3, lines 36-39; emphasis added). In other words, the capacitor charge current is the summation of multiple input currents, CTAT current 290 and PTAT current 390. In particular, Nolan teaches that the currents of both the CTAT 200 and PTAT 300 current generators are required to provide the capacitor charging current.

Furthermore, Applicant understands Nolan to teach that the precision relaxation oscillator provides three operating modes. However, both the CTAT and PTAT current generators are both used to generate the capacitor charging current, regardless of operating mode of the oscillator. In other words, the operating mode of the oscillator is not associated with a particular current generator. Each of the CTAT and PTAT current generators can adjust their respective output currents for fast or slow mode operation (col. 5, lines 12-16).

Both the CTAT and PTAT current generators generate different output currents depending on the mode of operation. Specifically, with reference to Figure 4 of Nolan, CTAT current generator 200 includes different resisters (resisters 232, 233 and 234) for controlling the current depending on whether the fast mode or the slow mode is

activated (col. 5, lines 28-40). Similarly, with reference to Figure 5 of Nolan, PTAT current generator 300 includes different resisters (resisters 332, 333 and 334) for controlling the current depending on whether the fast mode or the slow mode is activated (col. 6, lines 41-50). Therefore, regardless of the operating mode, both the CTAT and the PTAT current generators are operable to generate different output currents. Both of these output current are required and summed to generate the temperature independent capacitor charging current.

In contrast, embodiments of the claimed invention are directed towards a microcontroller including a relaxation oscillator circuit, in which the relaxation oscillator circuit includes "said first current source coupled to said control for establishing a first reference voltage for use in causing said relaxation oscillator to operate in a first power mode to generate a clock of a first accuracy, wherein said first current source is not used during said second power mode; and said second current source coupled to said control for establishing a second reference voltage for use in causing said relaxation oscillator to operate in a second power mode to generate a clock of a second accuracy", as claimed. In particular, the claimed embodiments recite that a particular current source is associated with a particular power mode. Moreover, the claimed embodiments recite that the first current source is not used during the second power mode.

With reference to Figure 3 of the present application, dual mode relaxation oscillator circuit 300 is shown. Dual mode relaxation oscillator circuit 300 operates in

two different power modes: a low power mode utilizing current source 302 and a very low power mode utilizing current source 304. Control 346 is used to switch between current source 302 and current source 304, so as to switch power modes. As described in the current specification, in one embodiment current source 304 is continuously on. Switching activity on current source 302 switches dual mode relaxation oscillator circuit 300 from very low power mode to low power mode. In one embodiment, current source 304 generates substantially less current than current source 302, thus having minimal effect on the current generated at current source 302 (page 13, line 15 through page 14, line 5).

In particular, Applicant respectfully asserts that each current source is associated with a particular power mode, and that at least one current source is switched off for a very low power mode. Therefore, Applicant respectfully asserts that Nolan does not teach, describe or suggest a relaxation oscillator circuit including a first current source for use in causing the relaxation oscillator to operate in a first power mode and a second current source for use in causing the relaxation oscillator to operate in a second power mode and "wherein said first current source is not used during said second power mode", as claimed.

Moreover, Applicant respectfully asserts that Nolan does not teach, describe or suggest a relaxation oscillator including digitally trimmable current sources. With reference to Figure 4 of Nolan, Applicant understands Nolan to teach that the current sent to current mirror 250 may be adjusted using resistors 232, 233 and 234, which

vary in impedance using resister select 236. In particular, CTAT current generator 200 includes a single current source, and adjusts the current using resisters of different impedance.

In contrast, embodiments of the claimed invention as recited in Claims 14 and 23 include the limitation of digitally trimmable current sources. As shown in Figure 3 of the present application, trimmable components 318, 320, 322 and 324 are current sources for generating currents. Trimmable components 318, 320, 322 and 324 are controlled by digital control bits 370 and work in conjunction to generate a current used to generate a capacitor voltage (page 13, lines 6-9 and page 15, line 21 through page 16, line 4). As described above, Nolan teaches the use of a single current source and multiple resisters to vary a current. In particular, Applicant respectfully asserts that Nolan does not teach, describe or suggest the use of digitally trimmable current sources, as claimed.

Applicant respectfully asserts that nowhere does Nolan teach, disclose or suggest the claimed embodiments of the present invention as recited in independent Claims 9 and 19, and that these claims are thus in a condition for allowance. Applicant respectfully submits the Nolan also does not teach or suggest the additional claimed features of the present invention as recited in Claims 10-14 which depend from independent Claim 9 and Claims 20-23 which depend from independent Claim 19. Therefore, Applicant respectfully submits that Claims 10-14

and 20-23 overcome the rejection under 35 U.S.C. § 102(e), and are in a condition for allowance as being dependent on an allowable base claim.

35 U.S.C. §103(a)

Claims 15-18 and 24-27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nolan. Claims 15-18 are dependent on independent Claim 9 and Claims 24-27 are dependent on independent Claim 19. Applicant has reviewed the cited reference and respectfully submits that the present invention as recited in Claims 15-18 and 24-27 is not rendered obvious by Nolan.

As described above, Applicant understands Nolan to teach an oscillator having two current generators that work in combination to generate a summed current, regardless of the operating mode of the oscillator. In order to compensate for temperature variations, Nolan teaches that the outputs of the two current generators are combined to generate a capacitor charging current. In particular, Nolan teaches that the currents of both the CTAT and PTAT current generators are required to provide the capacitor charging current. Moreover, Applicant understands Nolan to teach that the precision relaxation oscillator provides three operating modes, wherein the operating mode of the oscillation is not associated with a particular current generator. Specifically, both current generators are used to generate a summed current for each mode of operation.

In contrast, embodiments of the claimed invention are directed towards a microcontroller including a relaxation oscillator circuit, in which the relaxation oscillator circuit includes "said first current source coupled to said control for establishing a first reference voltage for use in causing said relaxation oscillator to operate in a first power mode to generate a clock of a first accuracy, wherein said first current source is not used during said second power mode; and said second current source coupled to said control for establishing a second reference voltage for use in causing said relaxation oscillator to operate in a second power mode to generate a clock of a second accuracy", as claimed. In particular, the claimed embodiments recite that a particular current source is associated with a particular power mode. Moreover, the claimed embodiments recite that the first current source is not used during the second power mode.

In particular, Applicant respectfully asserts that the claimed embodiments recite that each current source is associated with a particular power mode. Therefore, Applicant respectfully asserts that Nolan does not teach, describe or suggest a relaxation oscillator circuit including a first current source for use in causing the relaxation oscillator to operate in a first power mode and a second current source for use in causing the relaxation oscillator to operate in a second power mode and "wherein said first current source is not used during said second power mode." In contrast, by teaching that the output currents of both CTAT current generator and the PTAT current generator are used for all modes of operation, Nolan teaches away from such a configuration. Moreover, with regard to Claims 15 and 24, Applicant

respectfully asserts that Nolan does not teach the limitation of digitally trimmable current sources, as claimed.

Applicant respectfully asserts that nowhere does Nolan teach, disclose or suggest the claimed embodiments of the present invention as recited in independent Claims 9 and 19, and that these claims are thus in a condition for allowance. Therefore, Applicant respectfully submits the Nolan also does not teach or suggest the additional claimed features of the present invention as recited in Claims 15-18 which depend from independent Claim 9 and Claims 24-27 which depend from independent Claim 19. Therefore, Applicant respectfully submits that Claims 15-18 and 24-27 overcome the rejection under 35 U.S.C. § 103(a), and are in a condition for allowance as being dependent on an allowable base claim.

Claims 1-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nolan in view of United States Patent 5,235,617 by Mallard, Jr., hereinafter referred to as the "Mallard" reference. Applicant has reviewed the cited references and respectfully submits that the present invention as recited in Claims 1-8 is not rendered obvious by Nolan in view of Mallard.

Applicant respectfully directs the Examiner to independent Claim 1 that recites that an embodiment of the present invention is directed to (emphasis added):

An oscillator circuit comprising:
a relaxation oscillator circuit;
a first current source for establishing a first reference voltage for use in causing said relaxation oscillator circuit to operate in a first power mode to generate a clock of a first accuracy;
a second current source for establishing a second reference voltage for use in causing said relaxation oscillator circuit to operate in a second power mode to generate a clock of a second accuracy, wherein said first current source is not operable to establish said second reference voltage; and
a control coupled to said first current source and said second current source for switching between said first power mode and said second power mode.

Claims 2-8 that depend from independent Claim 1 provide further recitations of the features of the present invention.

As described above, Applicant understands Nolan to teach an oscillator having two current generators that work in combination to generate a summed current, regardless of the operating mode of the oscillator. In order to compensate for temperature variations, Nolan teaches that the outputs of the two current generators are combined to generate a capacitor charging current. In particular, Nolan teaches that the currents of both the CTAT and PTAT current generators are required to provide the capacitor charging current. Moreover, Applicant understands Nolan to teach that the precision relaxation oscillator provides three operating modes, wherein the operating mode of the oscillation is not associated with a particular current generator. Specifically, both current generators are used to generate a summed current for each mode of operation.

In contrast, embodiments of the claimed invention are directed towards a microcontroller including a relaxation oscillator circuit, in which the relaxation oscillator circuit includes "a first current source for establishing a first reference voltage for use in causing said relaxation oscillator circuit to operate in a first power mode to generate a clock of a first accuracy; a second current source for establishing a second reference voltage for use in causing said relaxation oscillator circuit to operate in a second power mode to generate a clock of a second accuracy, wherein said first current source is not operable to establish said second reference voltage", as claimed. In particular, the claimed embodiments recite that a particular current source is associated with a particular power mode. Moreover, the claimed embodiments recite that the first current source is not operable to establish the second reference voltage, which is associated with the second power mode.

In particular, Applicant respectfully asserts that the claimed embodiments recite that each current source is associated with a particular power mode. Therefore, Applicant respectfully asserts that Nolan does not teach, describe or suggest a relaxation oscillator circuit including a first current source for use in causing the relaxation oscillator to operate in a first power mode and a second current source for use in causing the relaxation oscillator to operate in a second power mode and "wherein said first current source is not operable to establish said second reference voltage", as claimed. In contrast, by teaching that the output currents of both CTAT current generator and the PTAT current generator are used for all modes of operation,

Nolan teaches away from such a configuration. Moreover, with regard to Claims 5 and 6, Applicant respectfully asserts that Nolan does not teach the limitation of digitally trimmable current sources, as claimed.

Moreover, the combination of Nolan and Mallard fails to teach or suggest this claim limitation because Mallard does not overcome the shortcomings of Nolan. Applicant understands Mallard to teach a transmission media driving system. In particular, Mallard does not teach, describe, or suggest a relaxation oscillator circuit including a first current source for use in causing the relaxation oscillator to operate in a first power mode and a second current source for use in causing the relaxation oscillator to operate in a second power mode and "wherein said first current source is not operable to establish said second reference voltage", as claimed. Moreover, with regard to Claims 5 and 6, Applicant respectfully asserts that Mallard does not teach the limitation of digitally trimmable current sources, as claimed.

Applicant respectfully asserts that nowhere does the combination of Nolan and Mallard teach, disclose or suggest the claimed embodiments of the present invention as recited in independent Claim 1, and that this claim is thus in a condition for allowance. Therefore, Applicant respectfully submits the combination of Nolan and Mallard also does not teach or suggest the additional claimed features of the present invention as recited in Claims 2-8 which depend from independent Claim 1. Therefore, Applicant respectfully submits that Claims 2-8 overcome the rejection

under 35 U.S.C. § 103(a), and are in a condition for allowance as being dependent on an allowable base claim.

CONCLUSION

Based on the arguments presented above, Applicant respectfully asserts that Claims 1-9 and 11-27 overcome the rejections of record and, therefore, Applicant respectfully solicits allowance of these Claims.

The Examiner is invited to contact Applicant's undersigned representative if the Examiner believes such action would expedite resolution of the present Application. Please charge any additional fees or apply any credits to our PTO deposit account number: 23-0085.

Respectfully submitted,
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